

B R E V I O R A

Museum of Comparative Zoology

CAMBRIDGE, MASS.

29 MAY, 1968

NUMBER 291

A NEW SPECIES OF *TRIBOLONOTUS* (LACERTILIA: SCINCIDAE) FROM BOUGAINVILLE AND BUKA, SOLOMON ISLANDS, WITH COMMENTS ON THE BIOLOGY OF THE GENUS

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INTRODUCTION

The skinks of the genus *Tribolonotus* are undoubtedly one of the most bizarre taxa of lizards. Indeed, many of their anatomical features such as abdominal glands (Parker, 1940), volar pores (Roux, 1930 and 1934; Parker, 1940), and single right functional oviduct (discussed below) are as yet unreported in other lizards. Among skinks, these features, as well as their anomalous head and body squamation, make them one of the most easily distinguished groups in an otherwise taxonomically difficult family.

In this paper we describe an unnamed species of the genus and discuss various aspects of the ecology, reproductive biology, and behavior of several species.

DESCRIPTION OF A NEW SPECIES OF *TRIBOLONOTUS*

During a recent period of residence (1962-1963) on Bougainville Island and a subsequent return trip (1966) to the northern Solomons, Parker collected a large number of specimens of a hitherto unnamed species of *Tribolonotus* on the islands of Bougainville and Buka. The new species is very similar in many details of squamation to *T. ponceleti* Kinghorn, 1937, which occurs on Bougainville and Shortland islands, and may therefore be known as

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TRIBOLONOTUS PSEUDOPONCELETI¹ new species

Holotype: Museum of Comparative Zoology (MCZ) 72914, an adult male collected by Fred Parker at Kunua, Bougainville, on 30 December 1962.

Paratypes (610 specimens): BOUGAINVILLE: KUNUA: MCZ 72767-72779, 72781-72785, 72790-72791, 72793-72805, 72807-72813, 72815-72829, 72831-72863, 72865-72866, 72868-72869, 72871-72873, 72875-72900, 72910-72912, 76148, 76155-76178, 76181-76191, 76193-76201, 76412-76469, 78094-78282, + 4 untagged specimens; American Museum of Natural History (AMNH) 92026-92058, + 10 untagged specimens; Australian Museum (AM) R 26603-26607; British Museum (BM) 1963.578-1963.584; Field Museum of Natural History (FMNH) 141982-141985, 152596; University of Kansas Natural History Museum (UKNHM) 98510-98511; Zoological Museum of Berlin (ZMB) 39155 (2 specimens). BOKU: MCZ 65878-65880, 67723-67726; AMNH 89433. KIETA: MCZ 65875-65877, 67249-67250. MATSIOGU area: MCZ 92423-92426, 92428, 92468, 92492-92495. MELILUP: MCZ 92429-92433. MUTAHI: MCZ 87615-87623, 88782-88794, 91467-91472, 92394-92422, 92427, 92434-92440. Above POPHEIARAI: MCZ 76179. RAMAZON RIVER (1600-2400 feet): MCZ 92502-92503.

BUKA ISLAND: MCZ 67706-67716, 73850-73861; AMNH 89434. KUBA: MCZ 92491.

Diagnosis: *Pseudoponceleti* differs from *blanchardi* of the Solomons in having two rows of enlarged vertebral scales instead of a single row as in *blanchardi*. *Schmidti* of the Solomons also has two rows of enlarged vertebral scales, but whereas these scales extend anteriorly to the single large parietal scale in *schmidti*, they only extend to a point just anterior to the level of the insertion of the forelegs in *pseudoponceleti*. Size is the easiest way to distinguish *ponceleti* from *pseudoponceleti*. The three specimens of

¹ The similarity in certain points of squamation between *T. ponceleti* and the new species, as well as their supposed sympatry (but see Ecology section of paper below), has caused the new species to be confused with *ponceleti* both in the field and in museum collections. Fortunately, this confusion has been carried over into the literature only once (Zweifel, 1966). To help clarify the taxonomic confusion, it seems best to take the path of least nomenclatural confusion and call the new species *pseudo-ponceleti*.

ponceleti known in collections range from 116-125 mm in snout-vent length, whereas the largest of 611 *pseudoponceleti* examined is only 73 mm in snout-vent length.

Gracilis and *novaeguineae* of New Guinea can be immediately distinguished from *pseudoponceleti* by means of the greatly enlarged spines on the two vertebral and paravertebral scale rows, and the head casque which, posteriorly, is raised above the level of the nape.

Pseudoponceleti differs from *annectens* of New Britain (known from the holotype and more recently from a second specimen in the Zoologisk Museum, Copenhagen¹) in several scale characters which are summarized here from Zweifel (1966; see Fig. 1). "In both species there is a prominent row of enlarged scales paralleling the much larger vertebrals, but where at midbody in *pseudoponceleti* there is one of these smaller scales for each vertebral, *annectens* has only one for every two vertebrals. There are two primary temporal scales in *pseudoponceleti* and three in *annectens*." The first infralabial in *pseudoponceleti* is long and thin and extends posteriorly almost to exclude the second infralabial from the edge of the lip, or in a very few cases (1 specimen in 46 examined by Zweifel, 1966) the first labial does just exclude the entire second infralabial from the edge of the lip. In *annectens* the first infralabial extends posteriorly to exclude the second (in the type) or the second and third (in the Copenhagen specimen) infralabials from the edge of the lip.²

Description (Fig. 2; also see fig. 1 in Zweifel, 1966): *T. pseudoponceleti* measures between 26 and 73 mm in snout-vent length, with the tail approximately 59 to 65 per cent of the total length. The pentadactyl limbs are well developed and overlap when adpressed to the body. The head is deep and rather triangular in shape when viewed from above. The longitudinal striations on the head, the keeled vertebral and caudal scales, and the enlarged scales on the sides and limbs give the animal a rather rugose appearance.

¹The locality data for this second known specimen of *annectens* are as follows: Yalom, 35 km S.E. of Cape Lambert, Gazelle Peninsula, New Britain. Elevation 1000 meters above sea level.

²As these infralabials are excluded from the edge of the lip, they might be called sublabials as Zweifel (1966) notes. We choose to call them infralabials here, however, to emphasize the proper homologous relationships.

The rostral is approximately $2\frac{1}{2}$ times as wide as deep. A very large frontonasal covers the dorsal surface of the snout, and prefrontals are absent. The frontal is slightly shorter than the frontonasal and touches this scale throughout its entire anterior length. The frontal is in contact with the 2 anterior supraoculars laterally and the frontoparietals posteriorly. There are 4 supraoculars. The frontoparietals are distinct or fused to varying degrees. A distinct interparietal is lacking. The single large parietal, within which lies the parietal eye, is bounded on both sides by a smaller anterior and posterior parietal scale.¹

The nostril is contained in a single nasal. A large, roughly rectangular loreal extends from the anterior corner of the eye to the nasal and first supralabial. There are 5 supralabials; the first is extremely long and thin and extends posteriorly to the level of the anterior half of the eye, thereby excluding the anterior $\frac{2}{5}$ of the large, rectangular second supralabial from the margin of the lip. A large 3rd and smaller 4th and 5th supralabial follow. Both the second and third supralabials border the smaller scales of the entirely scaly eyelid. There is a small scale above the 4th supralabial and two superposed scales are above the 5th supralabial. Posterior to these last 3 scales are the two temporal scales, of which the lower is about twice the size of the upper.

The mental is followed on either side by 5 or 6 infralabials. The first of these is long and thin and extends posteriorly about as far as does the first supralabial above. The first infralabial excludes approximately $\frac{1}{2}$ - $\frac{3}{4}$ of the second infralabial from the margin of the lip. A single large postmental is followed by a pair of very large chin scales which form a suture along the midline and are followed by a second part of chin scales of slightly smaller size. These chin scales are separated by 4 of the smaller gular scales.

All the large head scales bear longitudinal ridges or keels.

The tympanum is almost level with the surface of the head. Auricular lobes are lacking.

¹ Zweifel's (1966) interpretation of the single large median parietal as possibly resulting from the fusion of the interparietal and parietals seems perfectly plausible to us. In all other lygosomine skinks the parietal eye occurs in an interparietal which would argue for the interparietal's being part of the single median parietal of *Tribolonotus*. Zweifel's observation of the incomplete posterior median suture in the large parietal can certainly be seen in many *pseudoponzeleti* and again argues for the paired lygosomine parietals having become part of the single shield.

There are 21-26 pairs of enlarged, keeled, vertebral scales between the base of the tail and a point just anterior to the insertion of the forelimbs. Between each of these pairs of enlarged vertebrals there is usually a single small median scale.

The side of the body between the large vertebral scales and the large ventral scales is covered with many small granular scales and fewer enlarged, almost tubercle-like scales disposed in roughly oblique rows. Granular scales predominate in an area adjacent to and as wide as the vertebral rows, except for a row of slightly enlarged, keeled scales that alternate with the vertebrals.

The tubercle-like scales extend from the side of the body forward onto the side of the neck and dorsally onto the nape between the enlarged post-parietal scales and the anteriormost pair of enlarged vertebrals.

The ventral scales are large and at the level of the abdominal glands are roughly disposed in transverse rows 8 scales in breadth. Each ventral scale, except for those covering the abdominal glands, bears a small median keel and is drawn out to a point posteriorly. The scales covering the abdominal glands are smooth and lack the keel and posterior point. There are two large, keeled, preanal scales.

The scales of the limbs are rather strongly keeled, the keels being drawn up into almost tubercle-like projections on the scales of the upper and outer surfaces of the hind leg.

The scales of the tail are keeled and arranged in annuli.

The digits are covered above by single scales throughout most of their entire length, although at their base there may be 1 or 2 paired scales (Group I of Brongersma, 1942). There are 20-29 (17 on one apparently normally developed toe; see Table I) subdigital lamellae on the 4th (longest) toe. The lamellae on the basal third of the toe consist of paired scales, one scale being large and covering most of the subdigital surface and the other scale being small and laterally situated. The lamellae on the distal $\frac{2}{3}$ of the toe are smooth and consist of single scales.

Adult males have both palmar and plantar pores. The palmar pores are few in number (2-4), and are distributed in an arc on the anterior edge of the palm. The plantar pores (3-10) are distributed in two rows across the sole: a longer series from the extreme base of the 4th toe and a shorter series from the base of the 3rd toe. In larger males there may be one or two pores on the base of the 5th toe.

Females always lack palmar pores, and whereas all females have large plantar scales similar to those bearing pores in males, the

pores are developed in only some females. When present in females the plantar pores are less well developed and less numerous (1-6) than in males.

There is a pair of abdominal glands which are covered by 2 pairs of midventral scales lacking keels and the posterior median point.

Color (Fig. 2): In preservative, specimens are generally brown above and on the sides and light yellowish brown below. Most individuals are uniformly dark above, but some show various degrees of light tan to whitish mottling on the nape, back, and upper surface of the base of the tail. The lighter mottled pattern tends to be bilaterally symmetrical on the nape and back and is often expressed as 1 or 2 transverse, posteriorly projecting chevrons on the dorsal base of the tail.

Variation: There is a slight difference in the dorsal color of the Bougainville and Buka specimens (Fig. 2). *Pseudoponocleti* from Bougainville tend to be darker brown dorsally with less light mottling than is found in Buka specimens. In Buka *pseudoponocleti* the light dorsal color tends to be more pronounced, with a few individuals being predominately creamy tan on the body with some brown mottling.

The general differences in color pattern between the Buka Island and Bougainville populations are correlated with differences in the distribution of certain scale counts between the two populations (Table 1). Using the coefficient of difference (C.D.) statistic (Mayr, *et al.*, 1953) to determine the degree of joint non-overlap between the Bougainville and Buka populations in regard to these differences, the C.D. was found to be lower in each case than the minimum C.D. of 1.28 and 90 per cent joint non-overlap convention commonly accepted for giving subspecific recognition to two populations. These differences do not, therefore, seem to warrant subspecific recognition for the Bougainville and Buka populations.

Distribution (Fig. 1): *Tribolonotus pseudoponocleti* has been collected at several localities on Bougainville as well as on Buka, just north of Bougainville (Fig. 1). Altitudinally, the species is known from the coastal lowlands up to an elevation of about 4000 feet (in an area 7-8 miles east of Kunua, Bougainville). None of these skinks has ever been taken by Parker or his native collectors on the Buin Plain at the south end of Bougainville, however. In this region the species was only found from about 2000 feet and above in the mountains.

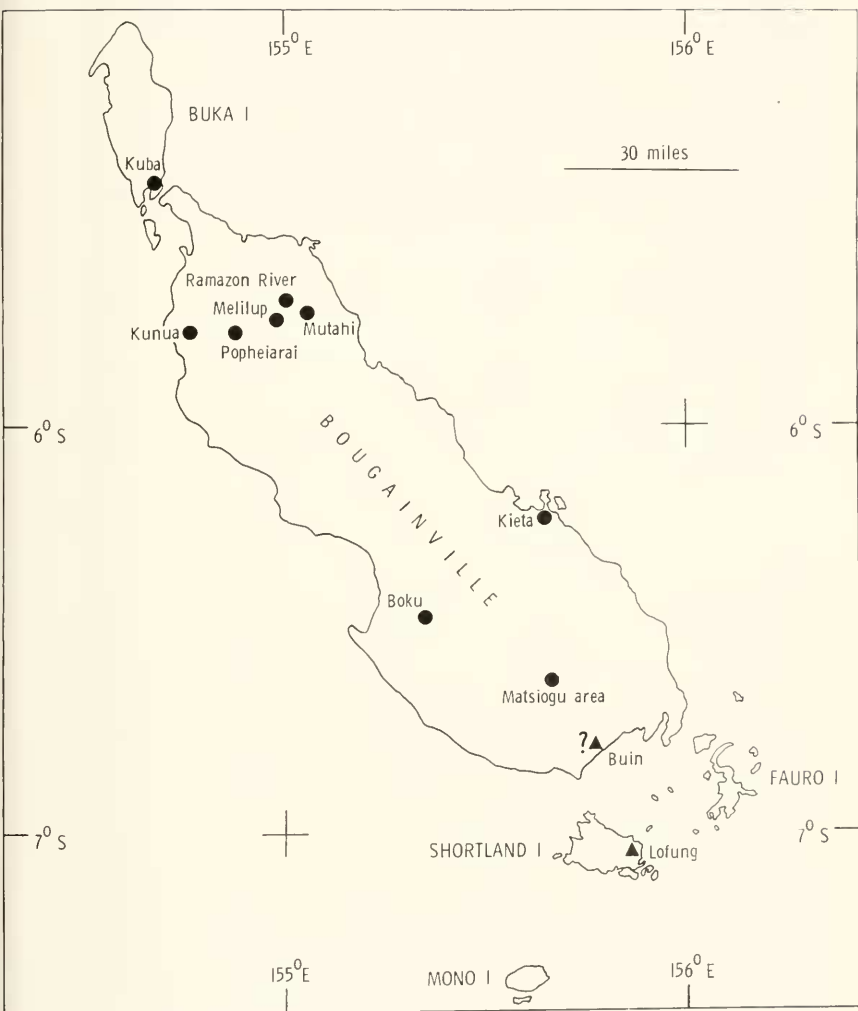


Figure 1. Map of Bougainville and surrounding islands showing the known collecting localities for *Tribolonotus pseudoponceleti* (circles) and *T. ponceleti* (triangles).

It is curious that the species was not found on Shortland in the Bougainville Straits, approximately 6.1 miles south of Bougainville. This smaller island is separated from Bougainville by a sea passage not more than 25 fathoms in depth and was probably connected with the mainland during the Pleistocene.

Comparisons: As Zweifel (1966) has provided a detailed comparison between *annectens* and *pseudoponceleli* (under the name *ponceleli*) as well as between *annectens* and other species of the genus, the comparisons in this section are limited to *annectens* and *ponceleli* and are intended to complement Zweifel's recent discussion.

In his diagnosis of *annectens*, Zweifel (1966) noted that the "ventral scales number 40 in *T. annectens*; 44 to 54 (mean 48.6) in 45 specimens of *T. ponceleli*." This particular difference between *annectens* and *pseudoponceleli* (Zweifel's *ponceleli*) is, however, less clear cut with the additional data now at hand. There are, indeed, generally more gular and ventral scales¹ in Bougainville (whence came all but one of the specimens of *pseudoponceleli* (42-54, avg. = 48.4) than in *annectens* (40 in the type, 46 in the Copenhagen specimen; avg. = 43.0), but the Buka Island population of *pseudoponceleli* has a somewhat intermediate number of gular and ventral scales (42-49, avg. = 45.0).

Until now *ponceleli* was known in the literature only from the single individual of the original description. Parker has, however, recently obtained two more specimens for the Museum of Comparative Zoology, which have allowed us to make direct comparisons between *ponceleli* and *pseudoponceleli*.

Other than size (see Diagnosis) there are several subtle differences in squamation between *pseudoponceleli* and *ponceleli*. In *pseudoponceleli* the first supralabial and infralabial, which are long and thin, extend posteriorly to at least the level of the anterior corner of eye, whereas in *ponceleli* the first supralabial and infralabial extend posteriorly only to a point about half way between the snout and the anterior corner of the eye. The position of the first supralabial thus permits the second supralabial to form a suture with the nasal in *ponceleli*, but in *pseudoponceleli* the first

¹ Counted along the ventral midline from the enlarged, paired chin scales to, but not including, the large, paired preanal scales (Zweifel's 1966 standardization). Presumably Zweifel's use of "ventral scales" in the preceding quote of this paragraph is meant to include the gular scales also.

supralabial meets the loreal, separating the second supralabial from the nasal. In *pseudoponceleti* the enlarged vertebral scales become poorly defined just anterior to the level of the insertion of the forelimbs, but in *ponceleti* the enlarged vertebral scales maintain their continuity farther on to the nape. The keels of the vertebral scales and two rows of tubercles just lateral to the vertebral scales are relatively larger and more pronounced in *ponceleti* than in *pseudoponceleti*. The one or two scales situated in the dorsal midline between a preceding and following pair of enlarged vertebrae are also relatively larger in *ponceleti* than in *pseudoponceleti*. There are two rows of plantar pores in male *pseudoponceleti*, one extending from the base of the 4th toe onto the sole and the other extending from the base of the 3rd toe onto the sole. In male *ponceleti* there is only one row of pores extending from the base of the 4th toe.

Breeding: *T. pseudoponceleti* is oviparous and lays but one oblong, leathery, shelled egg in a clutch. Furthermore, the left oviduct is reduced to a small, vestigial appendage of the cloaca leaving the right as the functioning oviduct. In only two of 101 females with oviducal and/or ovarian eggs collected at Kunua, Bougainville, was there a small yolky egg in the reduced left oviduct. These 2 eggs, however, did not appear to be viable.

It is noteworthy that the left ovary is still functional. Ten of the 101 females with oviducal and/or ovarian eggs had a single large yolky egg in the left ovary, but in all 10 females the left ovary had shifted to the right side, where, presumably, the ovulated eggs would pass into the right oviduct, i.e., the only functional oviduct. In no case was a large ovarian egg found in the left ovary when it was in its normal position on the left side of the body cavity. These data would indicate that as yolking proceeds in a follicle of the left ovary, the ovary is displaced to the right side, perhaps as a result of "crowding" with other internal organs, e.g., the stomach which tends to lie more on the left side of the body.

It would appear that ovulation of a second egg may occur just prior to or just after deposition of a preceding egg. This supposition is based on observations of single oviducal eggs the same size as the largest ovarian egg in the right oviduct just anterior to a full term egg in the same oviduct. In other cases there is simply a large ovarian egg and no oviducal egg. Such a situation would pertain if a full term oviducal egg had been laid just before ovulation of the second egg.

The 101 females with large ovarian eggs and/or oviducal eggs ranged in snout-vent length from 44-58 mm (avg. = 51.8 mm).

The smallest female contained a large, shelled oviducal egg. Given the large total sample size, it would appear that 44 mm is near the snout-vent length at which females first become capable of reproducing.

Ecology: *T. pseudoponceleti* is sympatric with *T. blanchardi* on Bougainville, although the two species occur in rather different ecological situations.

T. blanchardi is a montane species, and is probably to be found throughout the mountain ranges in the center of Bougainville. Specimens have been collected at 2000-3000 feet in the ranges north of Buin. Other specimens from the ranges east of Kunua were collected in river valleys from about 500-3000 feet. The habitat varies somewhat with altitude. In the lower altitudes where the ridges are still warm and comparatively dry, the species lives only in the steep sided and heavily shaded small creek valleys. At higher altitudes the species occurs farther from the waterways, but is still easier to collect along the creeks. The lizard does not live in the open in any environment, but prefers tall, shaded, primary forest and abundant moisture. In river and creek beds individuals are found under stones, logs and leaf rubbish at, and just above, water level, but only very occasionally may one be found moving on the ground. It often is found in company with *Sphenomorphus cranei* and *S. concinnatus*.

T. pseudoponceleti has a greater altitudinal range (coast to above 4000 feet) than *T. blanchardi*, but it is found more frequently at lower altitudes. *T. pseudoponceleti* is terrestrial and very secretive, living in and under decayed logs in all its types of habitat. It is common in swampy areas, and in some places is common on the plains where it is found in primary forest and in secondary growth. In addition, newly cleared gardens usually contain numbers of these skinks. The species likes moist conditions but not the very wet conditions preferred by *blanchardi*.

In the mountains there is little syntopy between the two species, because while *blanchardi* is confined to creek beds initially, then the shaded slopes of the steep ridges, *pseudoponceleti* is to be found only on the sharp ridges where the scrub is more open and the ground drier and warmer. This restriction to the ridges has been confirmed by extensive collecting east of Kunua from 2000-4000 feet. A number of other coastal species which range to about 2000 feet in the mountains are also confined to the drier ridge tops.

In the Boku area the natives believe *pseudoponceleti* prefers the hairy base of a large ground fern as a dwelling place, but this was not borne out by the breaking up of a number of these ferns in a

hunt for the species. The habitat in this area was decaying wood on the ground.

Whether *T. ponceleti* also occurs on Bougainville along with *pseudoponceleti* and *blanchardi* is uncertain. The single specimen from which the species was described (Kingham, 1937) was said to have come from "Buin, east Bougainville Island, Solomon Islands." However, there are no *ponceleti* among several hundred reptiles that Parker and his native collectors obtained in southern Bougainville near Buin.

Upon inquiry, Mr. Harold Cogger of the Australian Museum found the notes that accompanied Father J. B. Poncelet's zoological collection of which the single specimen of *ponceleti* was a part. The notes consist mainly of a list of the common English and native names for each of the specimens and are prefaced by an unequivocal statement regarding the provenance of the collection — "All those (*sic*) specimens have been collected at Buin (South Bougainville), 10 to 15 miles in the interior, during the months of September and October 1934, by Father J. B. Poncelet S.M., of the Buin Catholic Mission."

Native collectors have obtained the only other two known *ponceleti* at Lofung on Shortland Island (Fig. 1), but whether this large *Tribolonotus* also occurs on Bougainville is still an open question.

The presence of *ponceleti* and the absence of *pseudoponceleti* on Shortland Island seems well established. It is also fairly clear that *pseudoponceleti* is absent from the Buin Plain. It is not certain whether *ponceleti* occurs on the Buin plain, although it is fairly well established that *ponceleti* does not occur elsewhere on Bougainville where large collections have been made (Fig. 1). Reasons for the absence of *pseudoponceleti* from the Buin plain and Shortland Island are obscure as are the reasons for the absence of *ponceleti* from the rest of Bougainville, if this species occurs on Bougainville at all. There seem to be few ecological differences between the Buin plain, the other lowland areas of Bougainville where *pseudoponceleti* has been collected, and Shortland Island (Parker, personal observation).

As no noticeable ecological differences are known to be correlated with the ranges of *ponceleti* and *pseudoponceleti*, the only likely remaining explanation for their allopatry is possibly competitive exclusion — perhaps of a very dynamic nature. But this facile explanation seems implausible, as the great size difference between the two species would certainly suggest a difference in the utilization of the habitat by the two species.

On the basis of our present information there is little more that can be said beyond this description of the problem. The ecologic and geographic relationships of *ponceleti* and *pseudoponceleti* will be interesting field problems for future workers on Bougainville.

Little seems to have been published on the ecology or habits of the closely related species *T. gracilis* and *T. novaeguineae*, but Mr. Harold Cogger has written to us about his personal experience with *T. gracilis*. Mr. Cogger says, "I am familiar with this species only on Karkar Island, where I obtained approximately 90 specimens. All specimens collected by me, or in my presence, were found under decaying logs and other vegetation usually on the banks of small non perennial streams, up to an altitude of about 2,000 feet, usually in fairly dense primary or secondary forest."

Behavior: T. pseudoponceleti is cryptic in its habits and never moves about in the open. No lizards were ever collected or seen in the open, and none was found moving about at night. In captivity they will come into the open parts of the cage to eat if there is little or no light. When found in its usual habitat under logs *pseudoponceleti* makes no attempt to escape but may move away slowly if given time. When an individual is uncovered there seems to be an instinctive reaction to flatten on the ground to avoid being noticed.

Usually two adults, a male and a female, are found together, and occasionally, if the log is large enough, another pair or two or three partly grown specimens may be close by. Rarely is a lone individual found — a close search into the ground and log nearby usually reveals a second individual.

T. pseudoponceleti is not strictly speaking a burrower but moves through insect burrows and hollows in and under logs. In captivity the species will eat termites. The lizards seem to be keen sighted and can detect movements in a dimly lit room some 10-15 feet away from the cage containing captive skinks. Other species of skinks of different genera seemed to be able to detect similar movements only when within 5-6 feet of the cage.

T. blanchardi is very similar to *pseudoponceleti* in its behavior. It moves slowly, although when being chased it will make short bursts of speed to escape. In captivity it is not given to the quick, nervous movements found in other skinks, e.g., *Emoia* and *Sphenomorphus* species, either when frightened or feeding. When moving, the skink holds the whole body and sometimes the tail off the ground.

Virtually nothing is known of the ecology or habits of *ponceleti*. The two specimens of *ponceleti* collected for Parker by the natives at Lofung, Shortland, had dirt in the crevices between the scales

which may indicate that the species is something of a burrower. Many *pseudoponceli* also have dirt between their scales when collected and this species is known to spend much of its time in close contact with the soil in secretive situations.

VOLAR PORES AND ABDOMINAL GLANDS IN THE GENUS *TRIBOLONOTUS*

Among lizards, volar pores and the dermal abdominal glands are unique to the genus *Tribolonotus*. The presence of volar pores was first pointed out by Roux (1930) in male *T. schmidt* when he used them as a character diagnostic of a new genus — *Pediporus*. Roux (1934) later rectified this mistake when he found similar pores on some of the toes and sole of a male *T. novaeguineae* — the type species of the genus *Tribolonotus*.

Parker (1940) extended Roux's observations on volar pores of *gracilis* and provided additional information on their distribution in *schmidt* and *novaeguineae*. Parker also provided the first account of abdominal glands in the genus, having noticed them in male *gracilis* and *novaeguineae*.

Function: The function of both volar pores and abdominal glands is speculative. Secretion seems to be the primary purpose of both structures, and from the distribution of the glands on the body of the animal — belly and volar surfaces — it would seem as though the secretion would be placed in a new part of the microenvironment with every step taken by an animal. What, then, is the value of such a secretion?

The only information we have on the ecology of *Tribolonotus* is that given above for *blanchardi*, *pseudoponceli*, and *gracilis*. All three species appear to be highly secretive and spend most of their time under objects such as stones, leaf rubbish, and rotten logs — microhabitats that are both dark and relatively moist, and if the secretions are volatile and odiferous, they might be important olfactory signals.

Furthermore, the fact that both structures are generally better developed in adults than juveniles and in males rather than females suggests that their function may have some sexual significance. For instance, the secretions provided by the pores and glands may be olfactory markers of territory.

Distribution of volar pores in Tribolonotus (Table 2): The two known specimens of *annectens* are females and both lack volar pores.

Plantar pores occur in both male and female *pseudoponceleti* where they are found in a series behind both the 3rd and 4th toe. In some males, but never in females, there may be an additional pore or two on the basal third of the 5th toe. Palmar pores are present in males but not in females.

The three known specimens of *ponceleti* are males and all have a single series of plantar pores directly in line with the 4th toe (Fig. 3). Palmar pores are absent.

Both *gracilis* and *novaeguineae* females apparently lack volar pores. Males of both species have pores on the basal half of the 3rd and 4th toes and on the sole in a line directly behind the 3rd toe. Male *gracilis* possess palmar pores (personal communication, Harold Cogger *re* Karkar Island *gracilis*), but whether palmar pores are present or absent in male *novaeguineae* is unclear as yet.

Female *blanchardi* also lack volar pores. Males have both palmar and plantar pores which are distributed mainly on the palm and sole, although occasionally a pore is found on the basal third of one of the digits.

In *schmidtii*, females lack volar pores, but males have both palmar and plantar pores, the latter being distributed in two series: one behind the 4th toe and a second, shorter, series behind the 3rd toe.

Distribution of abdominal glands in Tribolonotus (Table 2): In the Copenhagen specimen of the female *annectens* which we have examined, the glands are covered by four pairs of median ventral scales.

Both sexes of *pseudoponceleti* have a single pair of unlobed abdominal glands lying beneath two pairs of midventral scales. The glands are slightly smaller in females than in males.

In *ponceleti*, which is at present known from only 3 males, the abdominal glands are bilobed and covered by one or two pairs of ventral scales (Fig. 3).

Female *gracilis* and *novaeguineae* lack abdominal glands, but in males of both species the glands are paired and unlobed and extend a distance of three or sometimes four ventral scales along the midline.

Female *blanchardi* also lack abdominal glands. Males have four pairs of bilobed abdominal glands which extend the length of four or five ventral scales.

The glands are very small and minutely lobed in female *schmidtii*, but the ventral scales covering the glands are not visibly different from the other ventral scales. In males the two pairs of ventral scales covering the glands are characteristically smooth along their posterior edges rather than mucronate as are the surrounding enlarged ventral scales.

REPRODUCTION IN TRIBOLONOTUS

The mode of reproduction is known for all the species of *Tribolonotus* except *ponceleti* which is known from only 3 male specimens. From an examination of gravid *annectens* (also see Zweifel, 1966:2), *blanchardi*, *gracilis* and *novaeguineae*, as well as *pseudoponceleti*, it would appear that these species are oviparous and produce but a single oblong leather shelled egg in a clutch in which little or no embryonic development takes place prior to deposition.

Schmidt is atypical of the genus in producing living young but typical in producing but one young at a time. Roux (1930:133) says of a single female he received from Guadalcanal, Solomon Islands, "Elle renferme un embryon bien developpe." The adaptive significance of live-bearing habits in *schmidt* are difficult to imagine and will probably remain obscure until more is known of the species' behavior and ecology.

It is interesting to note that *blanchardi* and *schmidt* are similar to *pseudoponceleti* in having only one functional oviduct, the right. In *blanchardi* and *schmidt* as in *pseudoponceleti* the left oviduct is reduced to a small vestigial appendage of the cloaca. In *blanchardi* the left ovary is still functional, and, as in *pseudoponceleti*, is usually displaced to the right side prior to ovulation. In *schmidt*, on the other hand, the left ovary is either absent or greatly reduced in size; in the latter case it is situated well posteriorly in the body cavity and is probably not functional.

Unfortunately the state of preservation of the four gravid *gracilis* and single gravid *novaeguineae* available for study was such that the condition of the left ovary and oviduct could not be interpreted.

These data are of further interest on two counts. First, it may well be that a single egg or young is characteristic of the taxon *Tribolonotus*. Such specificity in the number of eggs produced is not unusual in some groups, e.g. geckos, but it is unreported in any supraspecific taxa of skinks.¹

Second, a single functional oviduct has been previously unknown in reptiles except in some leptotyphlopids and typhlopids (Guibé, 1948; Robb, 1960; Fox and Dessauer, 1962). In these "worm snakes," as in *Tribolonotus*, it is the left oviduct that is non-functional. The left ovary in the leptotyphlopids and typhlopids is slightly smaller in size than the right ovary, although it is still

¹ Many *Emoia*, however, especially the smaller species, have but two eggs in a clutch (Greer, 1968).

functional. The left ovary seems to have lost all function in *Tribolonotus schmidtii*, but the large ova discovered in the left ovary of a few individuals of both *blanchardi* and *pseudoponceleti* would indicate that this organ is in some cases still functional in these species.

ACKNOWLEDGMENTS

We would like to thank Mr. Harold Cogger of the Australian Museum for his many contributions to the development of this manuscript. Not only did Mr. Cogger supply us with information on the type of *ponceleti* and his field experiences with *gracilis*, he also made many helpful criticisms and corrected several errors in an earlier draft of the paper.

Dr. E. E. Williams of the Museum of Comparative Zoology has also read the manuscript in several versions and has smoothed over many "rough spots" with each reading.

Part of the research (done by Greer) for this paper was supported by the Evolutionary Biology Fund which is administered for the National Science Foundation by the Evolutionary Biology Committee of the Biological Laboratories, Harvard University.

Dr. Richard G. Zweifel of the American Museum of Natural History very kindly read the final draft of the manuscript, and Miss Nancy Uhlar typed the final version of the paper.

Publication has been financed by NSF Grant GB 6944 to Dr. E. E. Williams.

A part of Parker's collecting expenses during his 1966 field work in the Solomon Islands was covered by a grant from the Science and Industry Endowment Fund of the Commonwealth Scientific and Industrial Research Organization of Australia.

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(Received 21 November 1967.)

TABLE 1

Frequency distribution for several meristic characters in the two island populations of *Tribolnotus pseudoponceleti*

BOUGAINVILLE

Enlarged, paired middorsal scales

x	21	22	23	24	25	26	N = 114
							$\bar{x} = 23.8$
f(x)	1	3	32	64	13	1	$\sigma = 0.75$

Gular + ventral scales

x	45	46	47	48	49	50	51	52	53	54	N = 106
											$\bar{x} = 48.4$
f(x)	8	8	17	26	22	10	9	1	3	2	$\sigma = 1.97$

Subdigital lamellae 4th toe

x	17	20	21	22	23	24	25	26	27	28	29	N = 211
												$\bar{x} = 23.9$
f(x)	1	2	18	24	44	41	44	18	15	3	1	$\sigma = 1.83$

BUKA ISLAND

Enlarged, paired and middorsal scales

x	22	23	24	25	N = 22
					$\bar{x} = 23.8$
f(x)	1	6	12	3	$\sigma = 0.77$

Gular + ventral scales

x	42	43	44	45	46	47	48	49	N = 22
									$\bar{x} = 45.0$
f(x)	1	6	3	3	3	4	1	1	$\sigma = 1.95$

Subdigital lamellae 4th toe

x	20	21	22	23	24	25	N = 42
							$\bar{x} = 21.8$
f(x)	3	14	15	8	1	1	$\sigma = 1.06$

TABLE 2

Distribution of volar pores and abdominal glands in the sexes of the seven known species of *Tribolonotus*

	Palmar pores		Plantar Pores		Abdominal glands	
	♂	♀	♂	♀	♂	♀
<i>annectens</i>	?	—	?	—	?	+
<i>pseudoponceleti</i>	+	—	+	+	+	+
<i>ponceleti</i>	—	?	+	?	+	?
<i>gracilis</i>	+	—	+	—	+	—
<i>novaeguineae</i>	?	—	+	—	?	—
<i>blanchardi</i>	+	—	+	—	+	—
<i>schmidtii</i>	+	—	+	—	+	+

TABLE 3

Species, number of specimens, snout-vent length, number of eggs/female, and comments on reproductive state of gravid *Tribolonotus* examined

Species	Number of gravid ♀♀ examined	Snout-vent length (mm)	Number of eggs/♀	Comments
<i>annectens</i>	2	49-50	1	"One large egg evidently nearly fully developed" in the type (Zweifel, 1966). Second egg in Copenhagen specimen with thick shell.
<i>pseudoponceleti</i>	101	44-58	1	Yolky ovarian eggs to large, leathery-shelled oviducal eggs.
<i>gracilis</i>	4	87-100	1	1 yolky ovarian egg; 3 large, leathery-shelled oviducal eggs.
<i>novaeguineae</i>	1	75	1	1 leathery-shelled oviducal egg.
<i>blanchardi</i>	9	31-36	1	Yolky ovarian eggs to large, leathery-shelled oviducal eggs.
<i>schmidtii</i>	12	34-38	1	Yolky ovarian eggs to terminal young.

Figure 2. Paratypes of *Tribolonotus pseudoponceleti* from Bougainville (MCZ 72914) and Buka (MCZ 67713), exemplifying the differences in dorsal coloration between the two island populations.






Figure 3. *Tribolonotus ponceleti* from Lofung, Shortland Island. Notice the pair of ventral scales overlying the abdominal glands, and the plantar pores in the ventral view of the specimen.

